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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013

BOEING

Attention: John Geroch

Subject: **BUILDING 2 IN-SITU- REACTIVE ZONE PILOT TEST WORKPLAN FOR BOEING REALTY CORPORATION, FORMER C-6 FACILITY, 19503 SOUTH NORMANDIE AVENUE, LOS ANGELES, CA**

Dear Mr. Geroch:

Please find enclosed for your review, a copy of the subject document prepared by Haley & Aldrich, Inc. for Boeing Realty Corporation.

If you have any questions concerning this document, please contact the undersigned at 562-593-8623.

Sincerely,

Stephanie Sibbett
Boeing Realty Corporation

Cc: Mario Stavale, Boeing Realty Corporation

enclosure

Building 2 *In-Situ* Reactive Zone Pilot Test Workplan

Boeing Realty Corporation,
Former C-6 Facility,
Los Angeles, California

PREPARED FOR

Boeing Realty Corporation

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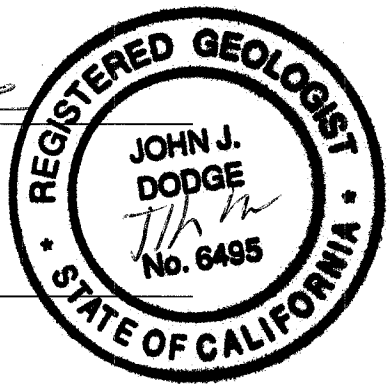

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Building 2 *In-Situ* Reactive Zone Pilot Test Workplan

Boeing Realty Corporation,
Former C-6 Facility,
Los Angeles, California

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1. Introduction/Background

Boeing Realty Corporation (BRC) is investigating soil and groundwater contamination at its 156-acre Former C-6 Facility (Site) located at 19503 South Normandie Avenue in Los Angeles, California (Figure 1). Previous investigations have shown the presence of volatile organic compounds (VOCs) in soil and groundwater at certain areas of the Site that require additional evaluation and/or remediation.

BRC evaluated several remedial approaches in preparation for remediating VOC-impacted groundwater. Based on the detailed evaluation of substantial historic groundwater quality monitoring data, enhanced biodegradation was selected as the most feasible remedial alternative to remediate the VOCs in the shortest time. This workplan presents an overview of the Site characteristics and the details of a pilot test proposed to verify the effectiveness of enhanced biodegradation of VOCs in groundwater and collect the additional information required for potential full-scale remediation design and implementation.

1.1 Site Characteristics

The Site is underlain by the Bellflower Aquitard which is a regional hydrogeologic feature in the Los Angeles basin. Vadose zone soils at the Site consist predominantly of silts, clays, and fine-grained sands, which are highly heterogeneous across the Site and are impacted in certain areas with VOCs. The primary VOCs found in soil include trichloroethylene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA). Groundwater at the Site occurs at a depth of approximately 60 to 65 feet below ground surface (bgs) under unconfined conditions and flows generally to the south. The water-bearing zone consists of two primary units, the Middle Bellflower Sand, which is the water-bearing unit, and the Lower Bellflower Aquitard, which separates the Middle Bellflower sand from the underlying Gage Aquifer. The Middle Bellflower sand extends to a depth of approximately 115 feet bgs and consists of three sub-units; the B-Sand, the Middle Bellflower Mud (BFM), and the C-Sand. The B-Sand is present from approximately 65 to 90 feet bgs and consists predominantly of a fine to medium sand. The BFM is a silt and clay layer that is present from approximately 90 to 95 feet bgs and appears to be present across much of the Site. The C-Sand is present from approximately 95 to 115 feet bgs and consists predominantly of a fine to medium sand. Groundwater at the Site has a relatively flat gradient (0.001 feet/foot) and flows predominantly to the south at a rate of approximately 10 to 20 feet per year. Groundwater at the Site is impacted with VOCs, primarily TCE and 1,1-dichloroethylene (1,1-DCE). Figure 2 illustrates the site-wide TCE impacts in groundwater in January 2001.

Groundwater quality has been characterized with data from 43 monitoring wells and 45 Simulprobe samples installed at strategic locations across the Site. Monitoring wells are generally screened within the top 20 feet of the groundwater. Simulprobe sampling was performed to evaluate the vertical distribution of VOCs in the B-Sand and the C-Sand. Source-area groundwater consists of the impacted groundwater with the highest concentrations of VOCs at the Site. Two primary groundwater source areas have been identified at Building 2 and Building 1/36. The Building 2 source area is the focus of this pilot test workplan.

Groundwater in the Building 2 area has been impacted primarily by TCE, is flowing in a southeasterly direction, and is the focus of this pilot test. Concentrations of TCE within the Building 2 area range from 160 to 13,000 µg/L with the highest concentrations being present in the B-Sand. These concentrations are illustrated in Figure 3. BRC developed and implemented an MNA (monitored natural attenuation) program to evaluate natural biodegradation processes at the Site. Based upon the data collected for the MNA program, groundwater in the Building 2 area is aerobic and has positive redox conditions. Groundwater in the Building 1/36 area is anaerobic (dissolved oxygen < 0.5 milligrams per liter [mg/L]) and has negative redox conditions (oxidation reduction potential less than –50 mV). Moderate nitrate and sulfate depletion, elevated dissolved iron, and trace amounts of methane have also been observed in the Building 1/36 area, and toluene and other potential electron donors (e.g., methylisobutyl ketone) are present. Because of the presence of electron donors, conditions in the Building 1/36 area are favorable for the biodegradation process of reductive dechlorination. Biodegradation is occurring as evidenced by the presence of the daughter product *cis*-1,2-DCE and the limited distribution of the high concentration area of the TCE plume. It is assumed the same microbial flora is present at Building 2 and the addition of electron donor will generate conditions similar to those observed at Building 1/36, resulting in biodegradation of the Building 2 TCE groundwater impacts.

1.2 Site Applicability & Measures of Success

Anaerobic *in-situ* reactive zone (IRZ) methods have successfully been applied to TCE and its daughter products in similar geologic settings to those encountered at the Site. The key to success will be engineering the process to deliver adequate organic carbon to insure an appropriate environment for reductive dechlorination can be maintained so that the process can proceed at an accelerated rate. Based on available Site data, daughter products have been detected in several wells on Site already. The presence of daughter products (notably *cis*-1,2-DCE) in the Building 1/36 area is also a Site-specific piece of evidence that indicates that an appropriate microbial population is

present at the Site. Daughter products were not detected from wells located within the vicinity of Building 2, however, one of the objectives of the pilot test is to create an environment that will result in TCE degredation (and daughter product generation) in this area.

As previously discussed, the major goal of the IRZ pilot test is to drive existing conditions to a more anaerobic and reduced state, and in so doing, degrade the source TCE. In order to monitor and measure the success of the process, three key elements will be monitored over the course of the pilot test:

1. **Delivery of adequate carbon substrate** to the subsurface will be measured by tracking total organic carbon (TOC) in the IRZ amendment points and monitoring wells. The target TOC concentration in the IRZ amendment points will be between 1,000 and 10,000 mg/L.

2. **Creation and maintenance of a reducing environment** capable of degrading the target VOCs. In order to assure that these conditions are created and maintained, dissolved oxygen (DO), ferrous iron, sulfide and oxidation/reduction potential (ORP) will be measured in the field. These indicators will be supplemented with several laboratory parameters such as nitrate, nitrite, sulfate, methane, and dissolved manganese. The target environment will be marked by strongly reducing conditions (ORP < -150 mV and DO less than 1 mg/L), increased ferrous iron, methane and sulfide concentrations, and reduced nitrate concentrations.

3. **Creation of daughter products will be monitored** using VOC analysis (for *cis*-1,2-DCE, and vinyl chloride [VC]), and light hydrocarbon analysis (for ethene and ethane). The ratio of source TCE concentrations to daughter products will be monitored over the course of the pilot test. A decline in the ratio is a positive indicator of success. In addition, an increase in the daughter product concentrations and the creation of ethene are also positive indicators of the technology's success.

The following sections discuss the objectives and specific tasks of the pilot test.

2. Pilot Test Objectives

The primary objective of the proposed pilot test is to verify the effectiveness of enhanced biodegradation as the most effective and efficient remedial method for groundwater remediation. Food grade carbohydrate amendments will be added to

create an IRZ to stimulate the natural VOC biodegradation processes. The pilot test will:

- Evaluate the ability to stimulate VOC biodegradation processes.
- Evaluate the rate of VOC biodegradation and calculate amendment mass, concentration and delivery specification to achieve optimum degradation rates.
- Evaluate radius of influence per amendment point to evaluate potential full-scale implementation.
- Evaluate the ability to create relatively large IRZs for potential full-scale implementation.
- Evaluate amendment fate and transport characteristics.
- Develop future IRZ design parameters.

The following sections of this pilot test workplan detail the components of the proposed pilot test.

3. Building 2 Groundwater Enhanced Biodegradation Pilot Test

3.1 Technology Description

IRZ technology will be utilized to optimize and enhance biodegradation of VOCs. Enhancing the biologically mediated reactions by supplying additional organic carbon to the groundwater system drives the ORP to a lower, more strongly reduced state. This is accomplished by supplying the groundwater system with a carbohydrate source in the form of a mixture of carbohydrate and water. Carbohydrates are supplied using food-grade molasses or corn syrup. These are cost-effective and innocuous amendments that have been accepted by both state and federal regulatory agencies. Indigenous heterotrophic microorganisms are typically present and readily degrade the carbohydrates. Testing for these microorganisms is currently being performed. This metabolic degradation process utilizes available DO contained in groundwater, as well as other alternative electron acceptors, and as a result drives the system to a more anaerobic and reduced state. The bacterial community present in the aquifer prior to carbohydrate addition adapts to the changed biogeochemical aquifer conditions. In the enhanced subsurface environment the bacterial population adjusts and facultative

species begin to use alternative electron acceptors. In the absence of oxygen anaerobic populations grow. A bacterial community capable of fermenting carbohydrate sugars develops, producing volatile fatty acids, alcohols, and hydrogen. The volatile fatty acids and alcohols are further degraded to carbon dioxide and water and hydrogen is consumed as part of the reductive dechlorination process.

Hydrolysis and fermentation of carbohydrate ultimately result in the production of acetate and hydrogen, which serve as the most desirable sources of energy for bacteria using sulfate and carbon dioxide (CO_2) as electron acceptors. Methanogens use CO_2 as an electron acceptor and are the most noted anaerobic bacteria responsible for reductive dechlorination. The reductive dechlorination breakdown pathways, intermediates for VOCs commonly found as environmental contaminants, and the cycling of organic carbon in an IRZ are presented in Figures 4 and 5. With respect to the Site, reductive dechlorination is occurring in the Building 1/36 area and can be expected to occur in the Building 2 area once the appropriate donor is added. This is the focus of the Building 2 pilot test.

Once organic carbon (in the form of molasses or other food-grade carbohydrate) has been sufficiently delivered throughout the treatment area, subsequent additions of carbohydrate, if necessary, will be utilized to support the enhanced microbial population until the end of the pilot test. This maintenance carbohydrate dosing will occur at intervals to maintain a target TOC level sufficient to maintain the reduced environment that results from the activities of the enhanced microbial population. The reactive zone performance is measured by monitoring for the target contaminants (TCE, *cis*-DCE) and relative concentrations of degradation products and other indicator parameters in groundwater such as DO, ORP, pH, and specific conductivity.

The primary advantages of the IRZ technology at this Site include the following:

- Data from Building 1/36 indicate that biodegradation of chlorinated VOCs via reductive dechlorination can occur at this Site if an appropriate electron donor is present. The IRZ approach will facilitate placing the appropriate electron donor in the Building 2 area to enhance the biodegradation process.

- The food-grade electron donor proposed for use at this Site (i.e. molasses) can be easily delivered to the impacted groundwater depths (Bellflower B-Sand) through repeat application.

- The electron donor is also highly soluble and can move through both diffusive and advective processes into the finer-grained lithologies observed at this Site (Bellflower B-Sand and BFM), promoting reduction of residual contaminant mass which can serve as a long term source to groundwater.

- Flexible application allows for use as source area treatment in the Building 2 and Building 1/36 area as well as a barrier or containment approach downgradient of these locations if needed.

The geology in which the technology is being applied will exert considerable control over remediation efficacy. Mass transfer and distribution rates in porous media are the primary factors influencing the efficiency of the IRZ technology. The groundwater seepage velocity, soil permeability, and the extent and depth of the TCE impacts have all been considered. These elements of the design have been factored into the amendment point layout, the distance between the amendment points and the screened zone selected. Details regarding monitoring wells and amendment point location and construction are provided in Section 3.2.

3.2 Building 2 Pilot Test

3.2.1 Amendment

The selected carbohydrate amendment will be food-grade molasses. Molasses is an easily biodegradable carbon source that has a half-life on the order of a few days. In addition, molasses is edible and an innocuous food-grade material and no undesirable effect is expected from its use. A Material Safety Data Sheet (MSDS) and product information for molasses is included as Appendix A. The IRZ technology using molasses has been accepted by both federal and state regulatory agencies at more than 80 sites throughout the United States. More specifically, several sites in southern California are in progress. These sites are listed below:

- Electronics Manufacturer, City of Industry;

- Aerospace Company, Newbury Park;

- Automotive Manufacturer, Newport Beach;

- Electronics Manufacturer, Santa Ana;

- Dry Cleaner, Mission Viejo; and
- Aerospace Company, San Marcos.

The initial carbohydrate delivery event planned for this pilot test is scheduled for approximately September 24, 2001. If necessary, subsequent carbohydrate delivery events will be conducted in order to assure that the target TOC concentration has been achieved (as measured during the Process Monitoring event). Additional carbohydrate delivery event(s) will be conducted based on the data collected during the pilot test. Other parameters (including ORP and DO) will also be evaluated and considered before additional carbohydrate is added.

Carbohydrate solution will be mixed with potable water at the Site to create an approximate 13 percent carbohydrate solution. The carbohydrate solution added to each amendment point will be less than 3 percent of the available pore volume within the estimated diameter of influence around each of the IRZ amendment points. The amendment will be degraded in the subsurface as a function of the volume added, the solution strength, the rate of groundwater flux, the age and stage of development of the microbial population and the presence and nature of available electron acceptors. The amendment will be consumed as it is metabolized by the microbial population, and diluted via advective and dispersive mechanisms through the groundwater.

3.2.2 Amendment Addition

One of the primary challenges associated with IRZ is delivery of the carbohydrate solution. This will be addressed by installing temporary IRZ amendment points within the impacted zone. IRZ amendment points will be closely spaced (30 foot center-to-center distance between points) inside the 10,000 micrograms per liter (µg/L) TCE plume to aggressively add carbohydrate solution in the highest VOC concentration area. The lines of IRZ amendment points located between the 5,000 and 10,000 µg/L TCE plume lines will be spaced 45 feet on center; the points within each line will be spaced at 30-foot centers. Figure 6 illustrates the proposed locations of the IRZ amendment points. Two IRZ amendment point configurations will be used to accommodate the variability in geology and TCE distribution across the target area. Within the 10,000 µg/L iso-contour line the IRZ amendment points will be installed as pairs. The shallow point will be screened to target the upper saturated sandy-silt layer (located between 65 and 75 feet bgs), while the deeper point will target the B-sand zone (screened from approximately 75 to 90 feet bgs). Each amendment point will be ¾-inch diameter with a 5 to 15 foot long screened zone. The amendment points will be

screened across the entire target zone (sandy silt or B-Sand) and will be completed at land surface with a removable cap (Figure 7).

The second IRZ amendment point configuration will be a single point screened to address the saturated unit from the groundwater table to approximately 85 to 90 feet bgs. Each point will be ¾-inch diameter, with a 20 to 25 foot long screened zone. The amendment points will be screened across the entire target zone (sandy silt and B-Sand) and be completed at land surface with a removable cap. The second IRZ amendment point configuration will be used between the 10,000 µ/L iso-contour and the area roughly coinciding with the 5,000 µ/L iso-contour.

The reagent solution will be mixed above ground at a centrally located temporary mixing tank. One or more pilot test distribution systems will be used to deliver the solution. Each system will be connected to several IRZ amendment points for simultaneous solution addition. A quick connect/disconnect feeder manifold will be used to connect to the points. The feed line to each IRZ amendment point will include a flow rate meter and ball valve. Water and molasses will be mixed at the proper ratio and then added under pressure to provide adequate coverage and distribution.

The carbohydrate solution volume, concentration, and frequencies may be adjusted based on the results of field monitoring.

3.2.2.1 IRZ Amendment Point Installation

IRZ amendment points will be installed in the proposed pilot test area. Locations of the IRZ amendment points are illustrated on Figure 6. The points will be installed using a cone penetrometer testing (CPT) rig to advance a 1.75 inch diameter hollow rod with a steel tip to approximately 75 or 90 feet bgs. A ¾-inch diameter schedule 40 polyvinyl chloride (PVC) casing and screen will be inserted into the steel rod to the bottom of the borehole. The steel rod will be carefully removed leaving the PVC casing and screen in place. Slotted PVC (with 0.01-inch slots) will be used below the groundwater table (approximately 65 feet bgs) to the bottom of the borehole. A construction permit will be obtained from the Los Angeles County Department of Health Services for the amendment points prior to installation. A typical amendment point construction detail is presented in Figure 7. Nineteen of the proposed IRZ amendment points will be configured with two separate screened zones. These points are located within the 10,000 µ/L iso-contour, and include the following: IRZ-23, 26, 27, 30, 31, 33, 34, 37, 38, 42, 43, 45, 46, 47, 49, 50, 51, 54, and 55.

3.2.3 Bromide Tracer

A small amount of bromide tracer will be dissolved in the amendment solution that is used at IRZ-2, IRZ-37 and IRZ-95 (upgradient of the IRZ-MW wells). Potassium bromide (KBr) powder will be used as a source of bromide. The tracer will be used to determine groundwater flow rates and confirm estimated vectors and lateral spread of the IRZ. The concentration of the bromide solution in the amendment injection will be approximately 100 to 300 mg/L, in order to achieve a reasonable, measurable concentration in groundwater down gradient of the amendment point. Bromide has been accepted by state and federal agencies as a tracer for similar applications.

3.2.4 Pilot Test Monitoring

Groundwater monitoring will be conducted during implementation of the IRZ pilot test. Three types of monitoring events are planned: a baseline sampling event (prior to addition of carbohydrate solution); process monitoring events; and performance monitoring events. Process monitoring will be conducted approximately 2 weeks after the initiation of carbohydrate solution amendment addition and approximately once per month thereafter. This sampling event will include field monitoring for pH and laboratory TOC analysis. Performance monitoring will be conducted approximately 6 weeks after the initiation of carbohydrate solution amendment addition and approximately every 6 weeks thereafter. The performance monitoring events will consist of a more comprehensive suite of analytes. If additional carbohydrate delivery event(s) are needed, then additional process and performance monitoring event(s) may also be conducted.

Monitoring will be conducted from four nested well pairs (IRZ-MW1 though IRZ-MW4). In addition, three IRZ amendment points will be sampled for select parameters. One will be located within the 10,000 µg/L iso-contour (IRZ-37) and two will be located between the 5,000 and 10,000 µg/L iso-contours (IRZ-2 and IRZ-95). Figure 6 illustrates the locations of the monitoring wells. Details of the monitoring program are discussed in the following sections.

The frequency, wells and points sampled, and the list of analytes may be changed based on the data collected during each sampling event. Any changes and rationale for the changes will be presented in the report presenting the results of this pilot test. This flexibility is necessary to assure that adequate, relevant water quality data is collected as the test progresses.

3.2.4.1 Monitoring Well Installation

Four temporary nested groundwater monitoring wells (IRZ-MW1 through IRZ-MW4) will be installed at the Site to monitor changes in groundwater conditions during the pilot test. Well IRZ-MW1 and IRZ-MW2 will be located within the 10,000 µg/L iso-contour, downgradient of IRZ amendment point IRZ-37. IRZ-MW1 will be 8 feet directly downgradient of IRZ-37 and IRZ-MW-2 will be 15 feet downgradient and 5 feet side-gradient of IRZ-37. These wells will be located inside the estimated diameter of influence of the amendment point to assess the carbohydrate solution and reactive zone distribution laterally and vertically inside the estimated 30-foot diameter-of-influence area. In addition, these two monitoring wells will specifically provide an assessment of the effect of the IRZ within the high concentration area.

Well IRZ-MW3 will be located 8 feet downgradient of IRZ-2 in the area upgradient of the 10,000 µ/L iso-contour and generally corresponding to the 5,000 µg/L iso-contour. This well will be used to assess the effect of the IRZ in less-impacted groundwater, as well as to collect information on the vertical distribution of the reactive zone.

Well IRZ-MW4 will be located immediately downgradient of the pilot test area. This monitoring well will be 15 feet downgradient and 7.5 feet side-gradient of IRZ-95. This well will provide longer-term data regarding the reactive zone formation, maintenance and effects.

The monitoring wells will be installed using a hollow-stem auger drill rig to approximately 90 feet bgs. Each well will have a shallow screened zone in the sandy silt zone and a second deep screened zone in the B-Sand zone. The wells will be constructed in a single 8-inch borehole. The deep screen will be 10 feet of 2-inch diameter 0.01-inch slotted PVC from approximately 75 to 85 feet bgs. The shallow screened zone will be 5 to 10 feet of 0.01-inch slotted PVC screen located approximately 65 to 75 feet bgs. The precise depth and length of the screened interval will be determined in the field to suit the conditions encountered. If the silty sand unit is not encountered, a single 20-foot screen will be installed. Each of the temporary monitoring well intervals will be isolated with a bentonite seal. A well construction permit will be obtained from the Los Angeles County Department of Health Services prior to installation. Typical monitoring well construction is presented in Figure 8. Locations of the proposed temporary monitoring wells are illustrated on Figure 6.

Three of the IRZ amendment points (IRZ-2, IRZ-37 and IRZ-95) will be used to collect supplemental data. These points will be sampled to provide information

specific to the amendment addition (i.e. TOC and pH) and how quickly it is consumed within the addition point. This information is important in determining the need for follow-on amendment additions.

3.2.4.2 Baseline Monitoring

Significant groundwater monitoring data exists for the Site including the Building 2 pilot test area. To augment this database, an additional baseline groundwater monitoring event will be conducted using the four IRZ monitoring wells and three IRZ amendment points located within the pilot test area to evaluate and document groundwater conditions prior to carbohydrate addition. These data will be added to the Site groundwater database and will provide a firm basis of conditions against which test performance can be compared.

Groundwater sampling will be collected from the three monitoring wells within the pilot test area (IRZ-MW1, IRZ-MW2, and IRZ-MW3), and one downgradient well (IRZ-MW4). Monitoring will also be performed in the three amendment points (IRZ-2, IRZ-37, and IRZ-95). Samples will be collected from these points and analyzed for the suite of analytes as summarized in Table 1.

During the baseline sampling event, groundwater samples will be collected and analyzed for a variety of organic and inorganic parameters to evaluate the geochemical environment in the area of concern. These analyses will include general groundwater quality parameters, electron acceptors, biodegradation byproducts, and VOCs. Field parameters (i.e., DO, ORP, temperature, pH, ferrous iron, hydrogen sulfide, and specific conductance) will also be collected from the wells.

General Groundwater Quality Parameters - These parameters are measured in groundwater at the wellhead for the wells associated with the pilot test, and include indicator parameters that can be used to measure the development of the reactive zone in groundwater. The parameters include ORP, pH, temperature, specific conductance, VOCs, and TOC. The relative presence of these compounds can also support the determination of the IRZ and the presence of biodegradation of the VOCs, and provide information for carbohydrate addition frequency and parameters.

Electron Acceptors - Analysis for electron acceptors indicate the relative levels of compounds present in the groundwater which serve as alternate electron acceptors once oxygen is depleted from the aquifer, and are a key indicator of anticipated success of the remedy. These compounds include DO, nitrate, iron, manganese, sulfate, and CO_2.

Biodegradation Byproducts - Analysis for the biodegradation byproducts indicate the relative levels of compounds formed by biodegradation and are therefore also a good indicator of reductive dechlorination. These byproducts include VOC daughter products, chloride, CO_2, methane, and ethene, and ethane.

Field parameters will be collected using a YSI meter and flow-through cell. Groundwater samples to be collected for laboratory analysis will be collected using low-flow purging and sampling methods. Hydrogen sulfide and ferrous iron are measured in the field using colorimetric methods.

3.2.4.3 Process Monitoring

Process monitoring will be conducted in weeks 2, 6, 12, 16 and 21. The purpose of these monitoring events is to measure the effect of the carbohydrate solution on the groundwater conditions at, and near, the IRZ amendment points. This information will be used to help determine the need for subsequent amendment additions. Groundwater samples will be collected using standard purge and bail methods and samples will be analyzed for pH using a field test protocol. Samples will also be sent to the laboratory for TOC analysis. Samples will be collected from IRZ-2, IRZ-37 and IRZ-95.

In addition, during the latter four sampling events the performance monitoring data collected from the monitoring wells will be used to supplement the process monitoring data collected from the three IRZ amendment points. The carbohydrate solution may be adjusted and/or additional carbohydrate delivery event(s) may be conducted based on the data collected during these events.

3.2.4.4 Performance Monitoring

Performance monitoring will be conducted at 6, 12, 16, 21 and 36 weeks after the initial carbohydrate delivery event. This monitoring will be more comprehensive than the process monitoring. Samples will be collected from some or all of the IRZ-MW wells in accordance with Table 1. Field parameters will be identical to the baseline event and groundwater samples will be collected from each monitoring well using low-flow purge techniques and will be analyzed for the parameters listed in Table 1.

This data will be used along with the performance monitoring data to evaluate the progress of the reactive zone development and to make decisions regarding supplemental amendment addition events.

3.2.5 Mid-Test Data Evaluation and Test Adjustments

3.2.5.1 Amendment Addition

Groundwater monitoring data will be reviewed and used to determine the need to adjust the strength, frequency, volume of the reagent additions, and possibly bioaugmentation. The ratio of TCE concentrations to daughter products will be evaluated over the course of the pilot test. If there is no or little decline in the ratio, then bioaugmentation will be evaluated to accelerate the remedial process.

3.2.5.2 Bioaugmentation

In some situations, the addition of select, adapted microbial populations that will target specific classes of organic compounds or provide the indigenous microbial consortia with additional compound or condition-specific microbes may be advantageous. This process is called bioaugmentation and it is sometimes used to accelerate the adaptation of the indigenous microbial consortia to speed up the remedial process. At many sites, bioaugmentation is not required because the microbes at the site have adapted to completely degrade the target contaminants; however at some sites, the environmental conditions have resulted in a stressed population and the rates of degradation are correspondingly low. Bioaugmentation can be used to shorten the acclimatization period of the microbial population responding to a substrate-only amendment. In any of these situations, the addition of chemical-specific degrading microbes may accelerate the degradation process, allowing remediation goals to be achieved more quickly.

For the BRC Site, bioaugmentation may be implemented if, after the preliminary rounds of analytical data collection, it appears that the addition of reagent has not resulted in adequate formation of daughter compounds and end products. Specifically, if the plume degradation stalls at the formation of *cis*-1,2-DCE or VC, and there is no evidence of ethene/ethane formation, the addition of targeted microbial cultures will be evaluated. The presence and concentration of TCE will also be considered, since some of the selected bacteria will not impact the degradation of these compounds.

If bioaugmentation is considered advantageous, BRC will notify the Los Angeles Regional Water Quality Control Board (LARWQCB) prior to the initiation. If bioaugmentation is implemented, groundwater monitoring will also include analysis of the microbial communities using a phospho-lipid fatty acid (PLFA) test on groundwater samples to allow for a quantitative evaluation of the degree of growth of

the microbial community. The other parameters already included in the analytical suite (such as CO_2, methane, ethene and ethane) will provide the final evidence that the stimulated (bioaugmented) communities are in fact resulting in more complete degradation of the target VOCs.

3.2.6 Removal of Pilot Test System

At the completion of the pilot test in early 2002, the IRZ pilot test system will be removed. Decommissioning of the system will include abandonment of all the temporary IRZ amendment points and the IRZ monitoring wells.

3.2.7 Post-Test Data Evaluation and Report

Field and analytical data collected from the Site will be evaluated over the pilot test period to closely monitor changes in the groundwater and to adjust the carbohydrate concentration and frequency, as needed. A summary report will be prepared at the conclusion of the test. The report will document pilot test activities, monitoring and sampling activities, analytical results, IRZ pilot test results, and recommendations for full-scale implementation, if appropriate. The report will be submitted to the LARWQCB by October 2002.

4. Sampling and Analysis Plan/QA

Monitoring wells will be gauged prior to collecting groundwater samples to determine static water levels and total well depth. Low-flow purging (less then 250 milliliters per minute) will be used as applicable for all sampling events to collect groundwater samples to minimize disturbance to the groundwater in the well.

Samples collected from each well will be tested for biogeochemical parameters using a YSI unit, field test kits, and fixed-base laboratory analyses. The YSI unit, with flow-through cell, will be used to measure pH, DO, ORP, specific conductance, and temperature. Hach, Inc. field test kits will be used to measure ferrous iron, DO, and hydrogen sulfide. Following field test kit analyses, groundwater samples will be collected for groundwater quality parameters, terminal electron acceptors, and degradation products. All samples to be analyzed for dissolved analytes, including metals, will be filtered in the field immediately following sample collection at each of the three well locations. For the process monitoring event, a pH meter will be used to measure the pH of bailed groundwater samples.

Samples collected for laboratory analyses will be properly labeled and packaged in cooled ice chests at a temperature of approximately 4 degrees Centigrade (°C) and delivered via commercial carrier to a state-certified laboratory (Severn-Trent Laboratories). Samples will also be sent to VaporTech Services, Inc. located in Valencia, Pennsylvania for dissolved gas analysis. Samples will be delivered using standard chain-of-custody protocol.

5. Residuals Management

Residuals generated during the implementation of the pilot test will include soil cuttings and groundwater monitoring well development and purge water. Soil cuttings generated during the drilling of the pilot test monitoring wells will be placed in a stockpile on plastic sheeting covered with plastic sheeting. Upon completion of drilling activities, the soil stockpile will be sampled and characterized for disposition in accordance with Site soil stockpile disposition protocols.

All groundwater monitoring well development and purge water will be contained in 55-gallon drums and labeled. The drums will all be stored in a common area of the Site designated by BRC. Upon completion of field activities, the 55-gallon drums will be characterized for proper off-Site disposition by BRC.

6. Schedule

The estimated duration of this pilot test is 5 months. Assuming this workplan is approved on August 24, 2001, the installation of the IRZ amendment points and monitoring wells will be initiated on August 31, 2001. Baseline monitoring and the carbohydrate delivery event will be initiated approximately on September 17 and 24, 2001, respectively. Monitoring events will be conducted as provided in Table 1. If needed, subsequent carbohydrate delivery and monitoring events will be added to the pilot test. The estimated schedule is summarized in Table 1.

TABLES

Table

TABLE 1. CARBOHYDRATE ADDITION AND GROUNDWATER MONITORING SCHEDULE FOR *IN-SITU* REACTIVE ZONE PILOT TEST
Boeing Realty Corporation, Former C-6 Facility (Building 2 Area), Los Angeles, California

			Week							
				0	2	6	12	16	21	36
		Workplan Approved	IRZ Amendment Point and Monitoring Well Installation	Baseline Monitoring	Carbohydrate Addition	Process Monitoring (5)	Performance Monitoring	Performance Monitoring	Performance Monitoring	Performance Monitoring	Performance Monitoring
		8/24/01	8/31/01	9/17/01	9/24/01	10/8/01	11/5/01	12/10/01	1/7/02	2/4/02	6/3/02
Amendment Addition					X						
Field Parameters	**EPA Analytical Method**										
Dissolved oxygen	NA[1][2]			x			x	x	x	x	x
Oxidation reduction potential (ORP)	NA[1]			x			x	x	x	x	x
pH	NA[1]			x		x (2)	x	x	x	x	x
Temperature	NA[1]			x			x	x	x	x	x
Specific conductance	NA[1]			x			x	x	x	x	x
Iron, ferrous	NA[2]			x			x	x	x	x	x
Hydrogen sulfide	NA[2]			x			x	x	x	x	x
Sulfides	NA[2]			x			x	x	x	x	x
Laboratory Analysis											
Volatile Organic Compounds	8260			x			x	x	x	x	x
Total organic carbon (TOC)	9060 Modified			x		x	x	x	x	x	x
Manganese, total	6010A			x						x	x
Manganese, dissolved	6010A			x			x	x	x	x	x
Iron, total	6010A			x						x	x
Sulfate	375.4			x			x	x	x	x	x
Nitrate	353.2			x			x	x	x	x	x
Nitrite	353.2			x						x	x
Chloride	325.2			x						x	x
Permanent Gases											
Dissolved Oxygen	VaporTech[3]			x			x	x	x	x	x
Carbon dioxide	VaporTech[3]			x			x	x	x	x	x
Nitrogen	VaporTech[3]			x			x	x	x	x	x
Methane	VaporTech[3]			x			x	x	x	x	x
Ethane	VaporTech[3]			x			x	x	x	x	x
Ethene	VaporTech[3]			x			x	x	x	x	x
Tracer											
Bromide	320.1			x			x	x	x	x	x
Wells To be Sampled (4, 5)				1,2,3,4		(5)	1,3	1,2,3,4	1,2,3	1,2,3,4	4

Notes:

(1) NA - not applicable. Parameters will be measured in the field using a YSI 6000 Water Quality Transmitter unit.

(2) NA - not applicable. Parameters will be measured in the field using a Hach test kit.

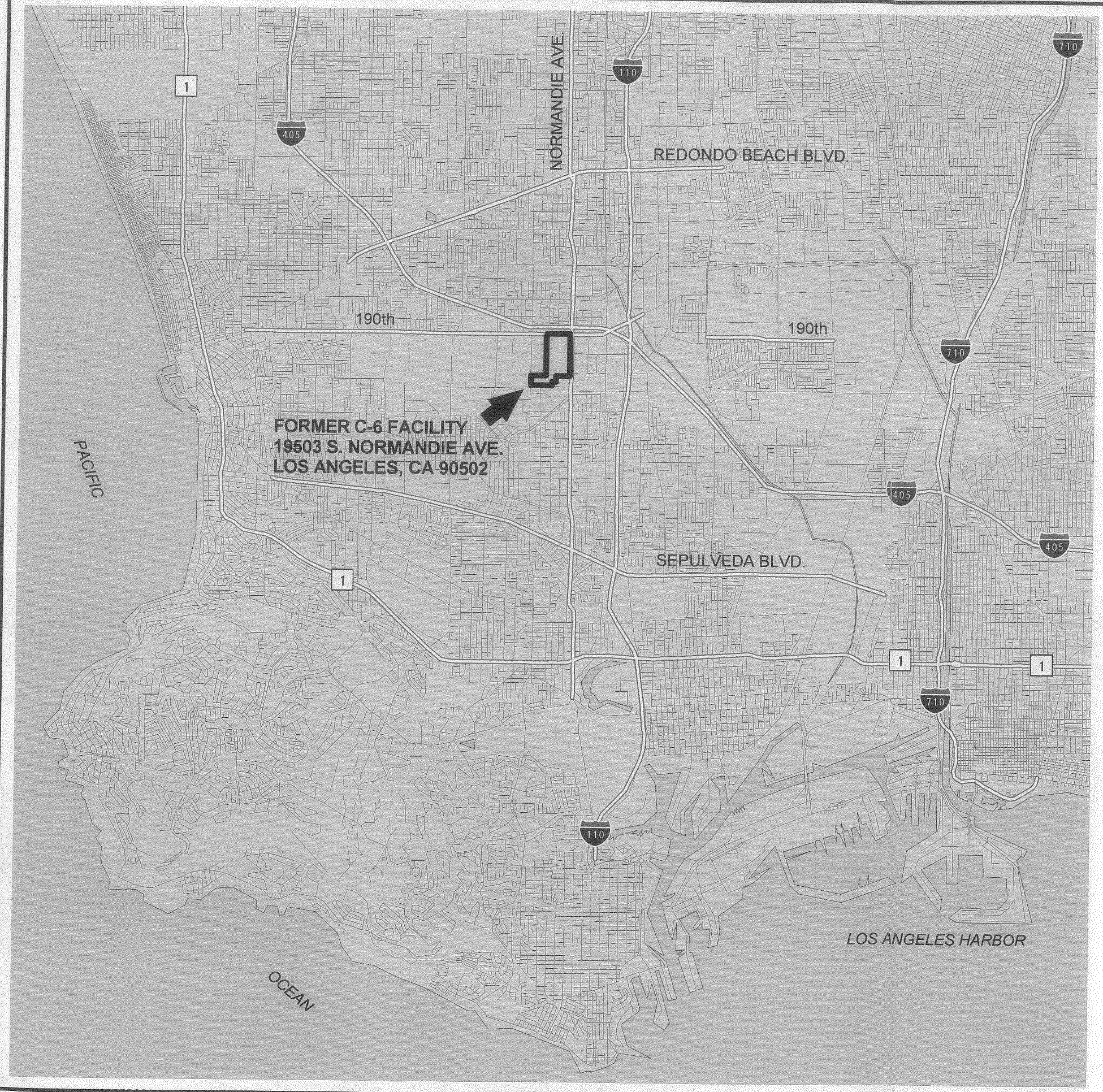
(3) Method developed by VaporTech, Inc.

(4) 1: IRZ-MW-1; 2: IRZ-MW-2; 3: IRZ-MW-3; 4: IRZ-MW-4

(5) The performance monitoring events will be conducted in weeks 2, 6, 12, 16 and 21 for TOC and pH. IRZ-2, IRZ-37 and IRZ-95 will be sampled as part of these events. During the baseline event, IRZ-2, 37 and 95 will be sampled for TOC, pH and VOCs.

FIGURES

Figures



N

EXPLANATION

BOEING REALTY CORPORATION:
FORMER C-6 FACILITY

REFERENCE:
Base map downloaded from 'Tiger File' data website hosted by ESRI.

0 1 2 Miles

APPROXIMATE HORIZONTAL SCALE

FIGURE 1

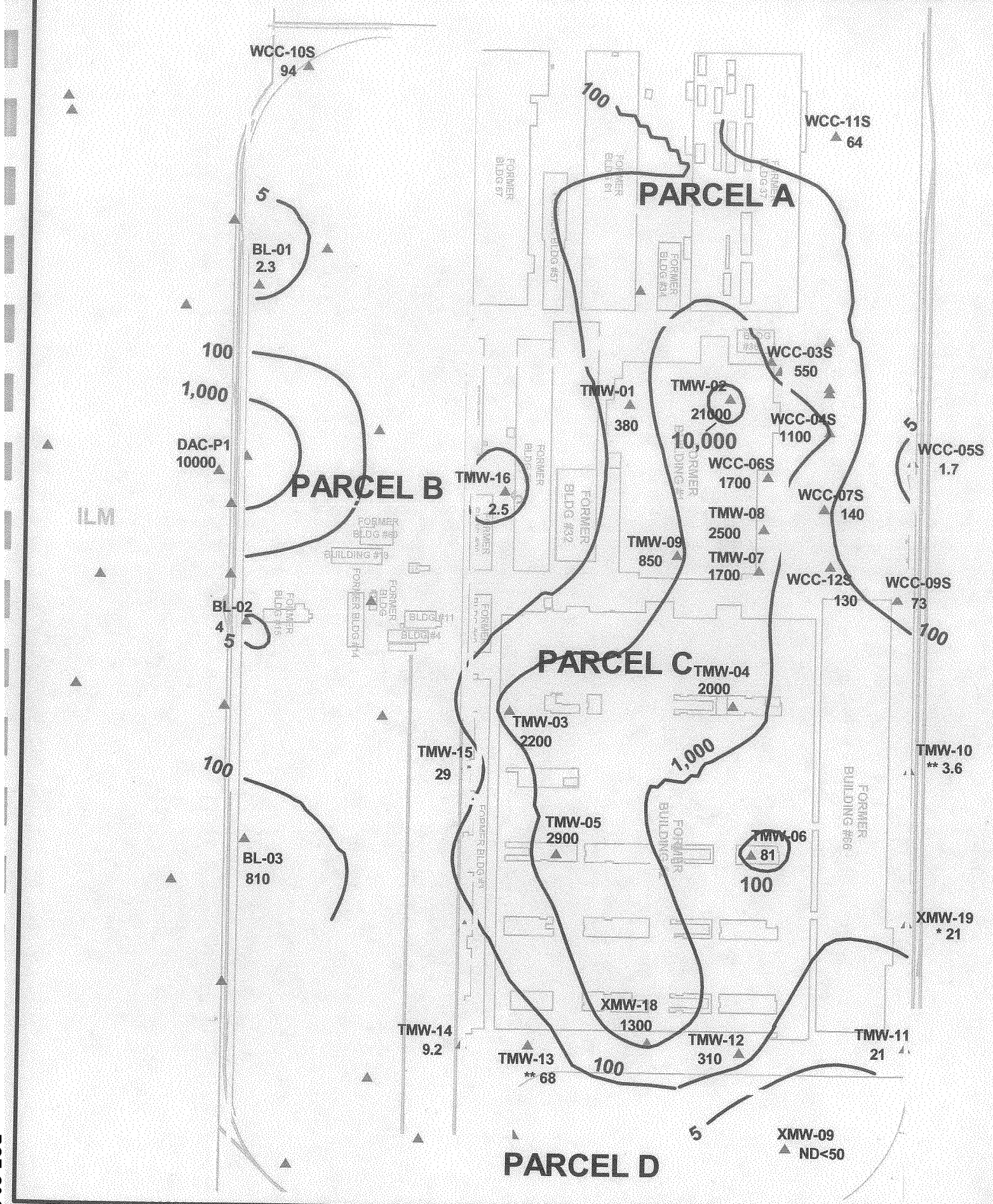
SITE LOCATION MAP

FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

PREPARED FOR
BOEING REALTY CORPORATION
LONG BEACH, CALIFORNIA

HALEY & ALDRICH
ENGLAND GEOSYSTEM
ENVIRONMENTAL ENGINEERING

BOE-C6-023034



N

EXPLANATION

WCC-11S ▲ 64	BOEING GROUNDWATER MONITORING WELL SHOWING TCE CONCENTRATION IN ug/l
▲	ILM GROUNDWATER MONITORING WELL
100	LINE OF EQUAL TCE CONCENTRATION IN µg/l

NOTES:
1. ISOCONCENTRATION CONTOUR INTERVAL = VARIABLE

REFERENCE:
AERIAL PHOTO PROVIDED BY GLOBE EXPLORER AND ORTHORECTIFIED TO NAD 83 CALIFORNIA STATE PLANE ZONE 5 IN FEET.

0 200 400 Feet

APPROXIMATE HORIZONTAL SCALE

FIGURE 2

TCE DISTRIBUTION IN GROUNDWATER JANUARY/FEBRUARY 2001

FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

PREPARED FOR
BOEING REALTY CORPORATION
LONG BEACH, CALIFORNIA

HALEY & ALDRICH
ENGLAND GEOSYSTEM
ENVIRONMENTAL ENGINEERING

BOE-C6-023035

DDS-1-15
DDS-1-14
TMW-4
DDS-2-18
DDS-2-17
DDS-2-16
DDS-2-15
TMW-12
AK-12
DDS-2-9
BLDG 2
DDS-2-19
METAL FINISHING
PAINT APPS
CHEMICAL STORAGE
DDS-2-10
3,000
5,000
DDS-2-11
S37
DDS-2-14
AK-14
MONTROSE_MW18
DDS-2-20
CHEMICAL STORAGE
CHEMICAL STORAGE
FUEL STORAGE
CHEMICAL STORAGE
AREA 2-1
D15
DRAINS
S37A
610
DDS-2-4
DEGREASER
DDS-2-8
DDS-2-21
DDS-2-7
CPT-2-2
10,000
13,000
DDS-2-5
DDS-2-12
DDS-2-13
TMW-5
5,000
?
BUILDING #2
3,200
DDS-2-3
910
DDS-2-6
TMW-13
5,000
7,000
3,000
500
DDS-2-2
3,600
CPT-2-1
TMW-3
360
DDS-2-1
500
?
G
BLDG 19
BLDG 3
TMW-15
TMW-14

N

0 25 50 100
FEET

SOURCE: BASEMAP PROVIDED BY BOEING IN NOVEMBER 1999.
TETRA TECH INC. 12/28/99

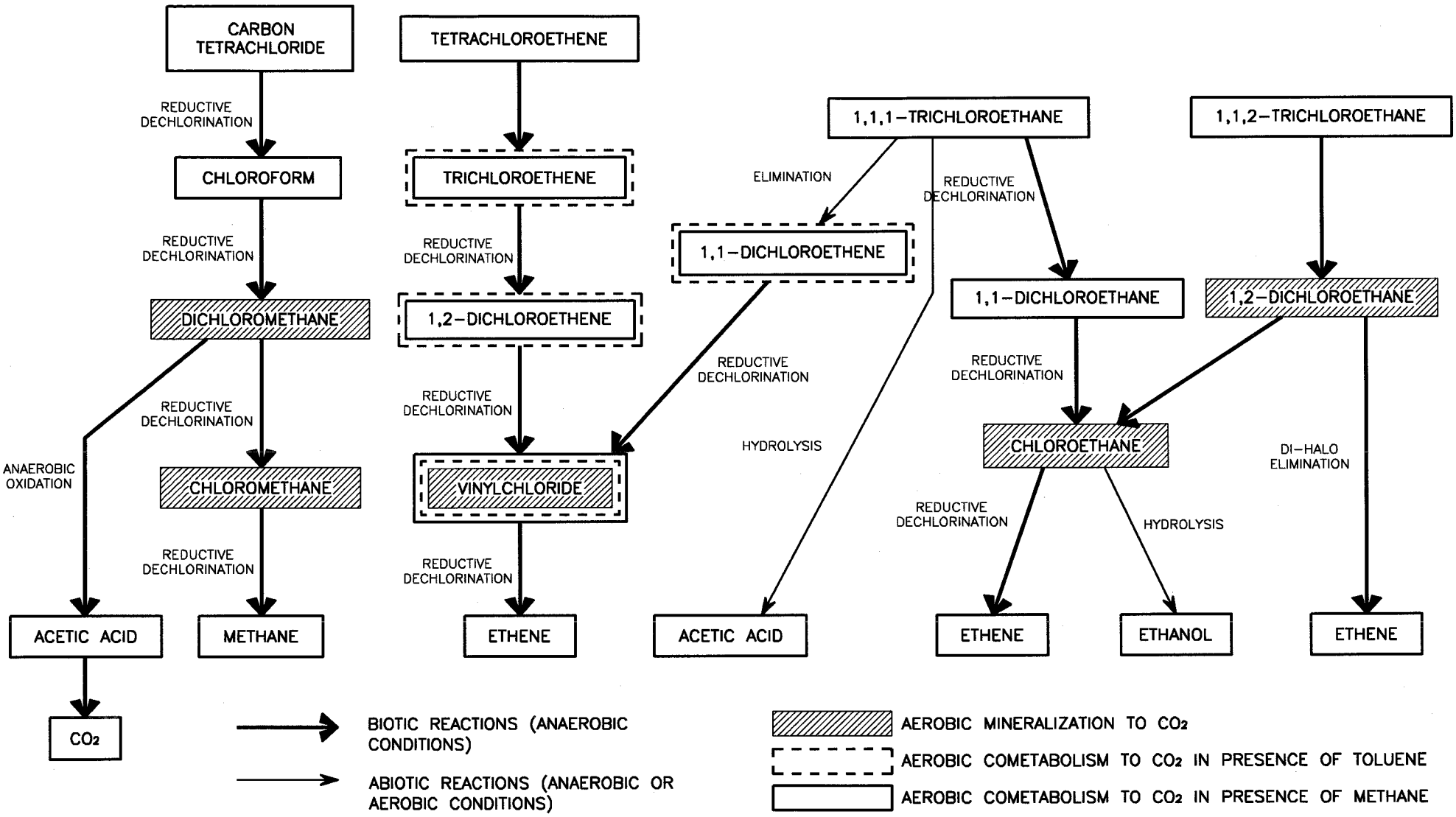
HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS
ENGLAND GEOSYSTEM

FORMER BOEING C-6 FACILITY
LOS ANGELES CALIFORNIA

FIGURE: 3

BUILDING 2
TCE GROUNDWATER IMPACTS
70-76 ft bgs

SCALE: AS SHOWN
PROJECT: 27285
DRAWN: SAL
REVIEWED: SZ
DATE: 8 MAY, 2001



SOURCE: INTERSTATE TECHNOLOGY AND REGULATORY COOPERATION WORK GROUP (ITRC), MAY 1999, NATURAL ATTENUATION OF CHLORINATED SOLVENTS IN GROUNDWATER: PRINCIPLES AND PRACTICES, WWW.ITRCWEB.ORG

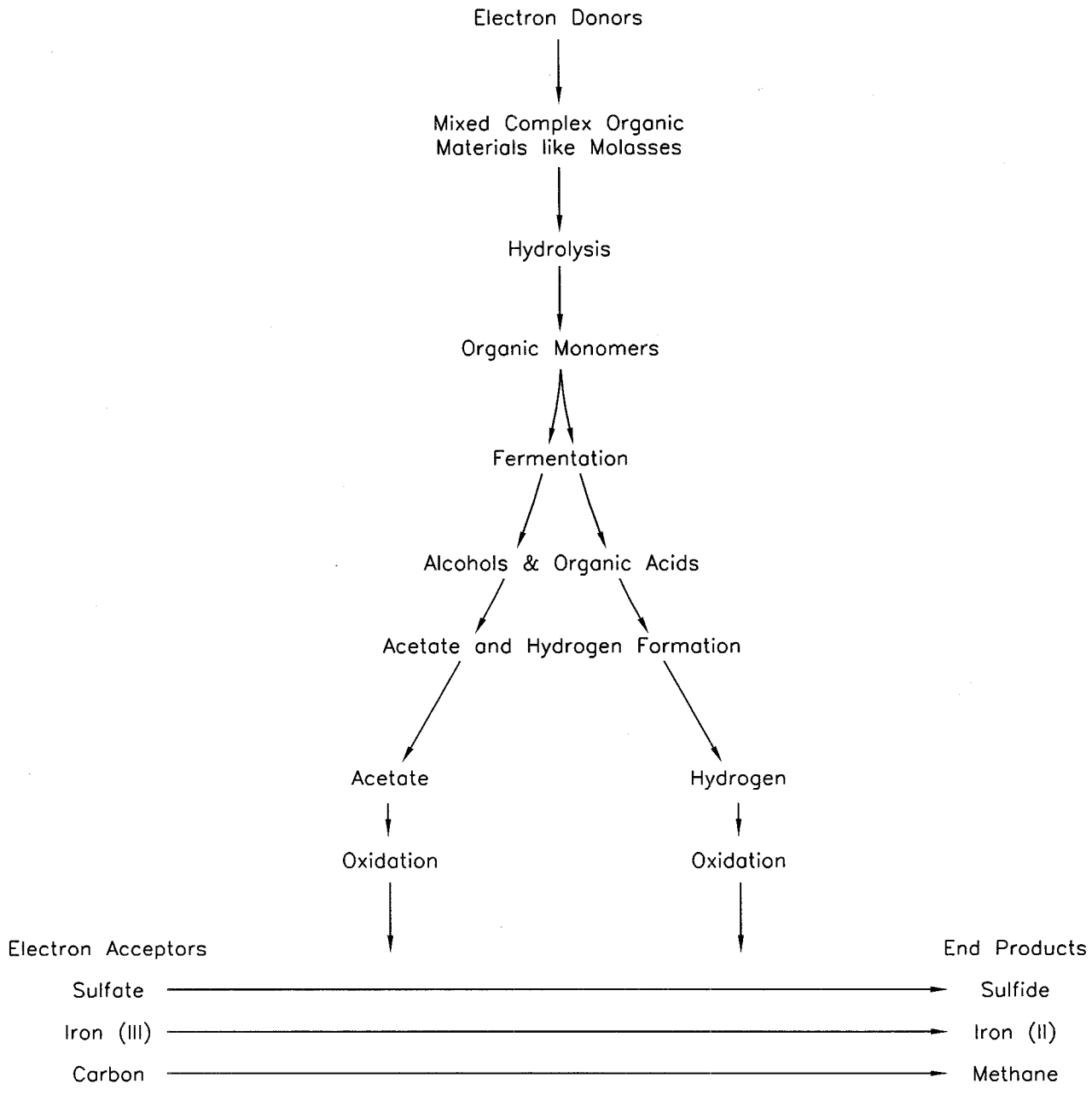
ARCADIS GERAGHTY&MILLER

COMMON DEGRADATION PATHWAYS

BOEING REALTY CORPORATION,
FORMER C-6 FACILITY (BUILDING 2 AREA)
LOS ANGELES, CALIFORNIA

FIGURE 4

BOE-C6-0233037



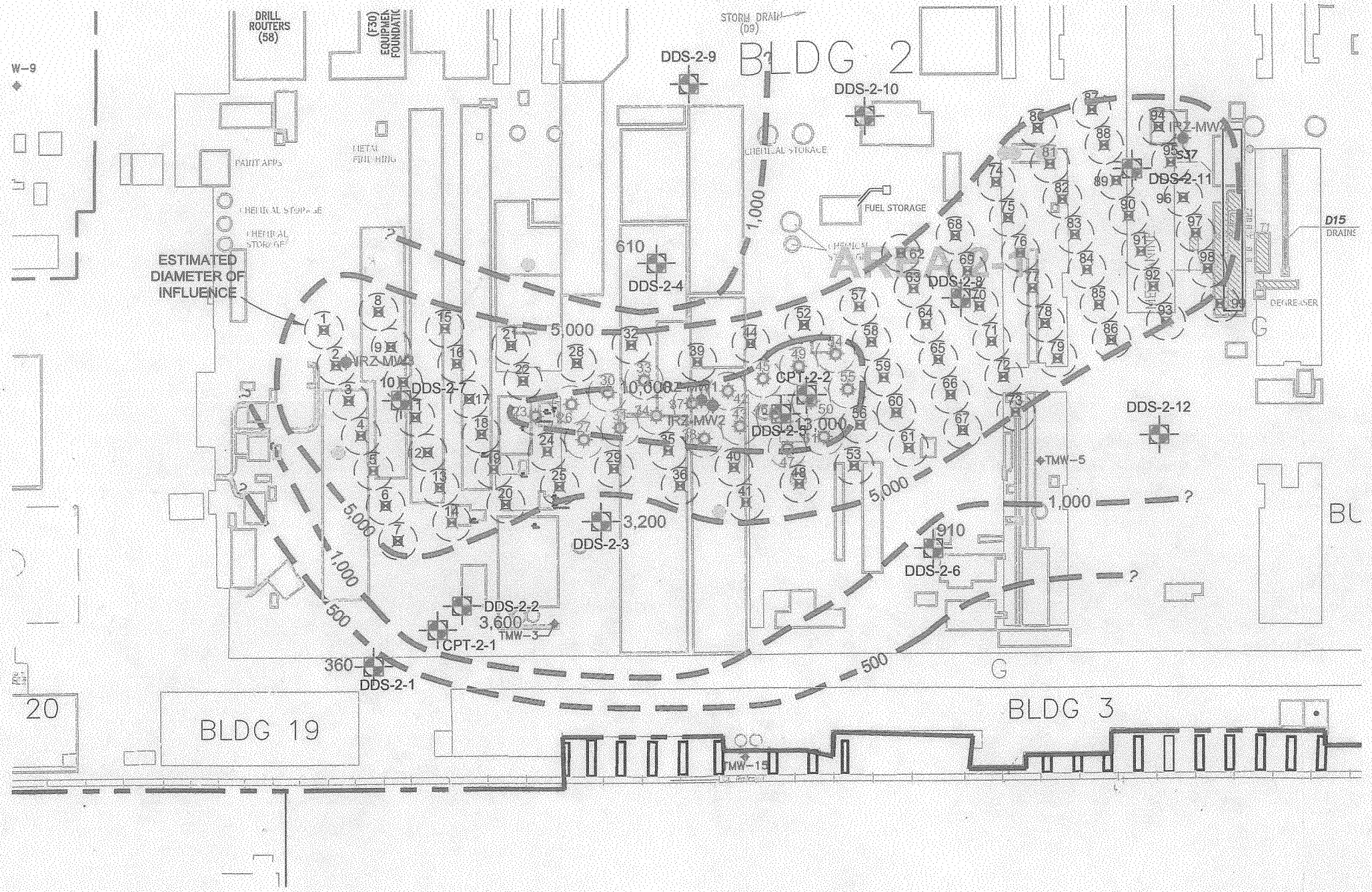
ARCADIS GERAGHTY&MILLER

CYCLING OF ORGANIC CARBON IN AN IRZ

BOEING REALTY CORPORATION,
FORMER C-6 FACILITY (BUILDING 2 AREA)
LOS ANGELES, CALIFORNIA

FIGURE

5



0 25 50 100
FEET

SOURCE: BASEMAP PROVIDED BY BOEING IN NOVEMBER 1999.
TETRA TECH INC. 12/28/99

LEGEND

- IRZ-MW2 — PROPOSED MONITORING WELL LOCATION
- 29 — PROPOSED IRZ AMENDMENT POINT (DESIGNATION AS IRZ-#)
- 27 — PROPOSED DUAL IRZ AMENDMENT POINT
- GROUNDWATER GRAB SAMPLE LOCATION

IRZ DESIGNED BY: ARCADIS G&M

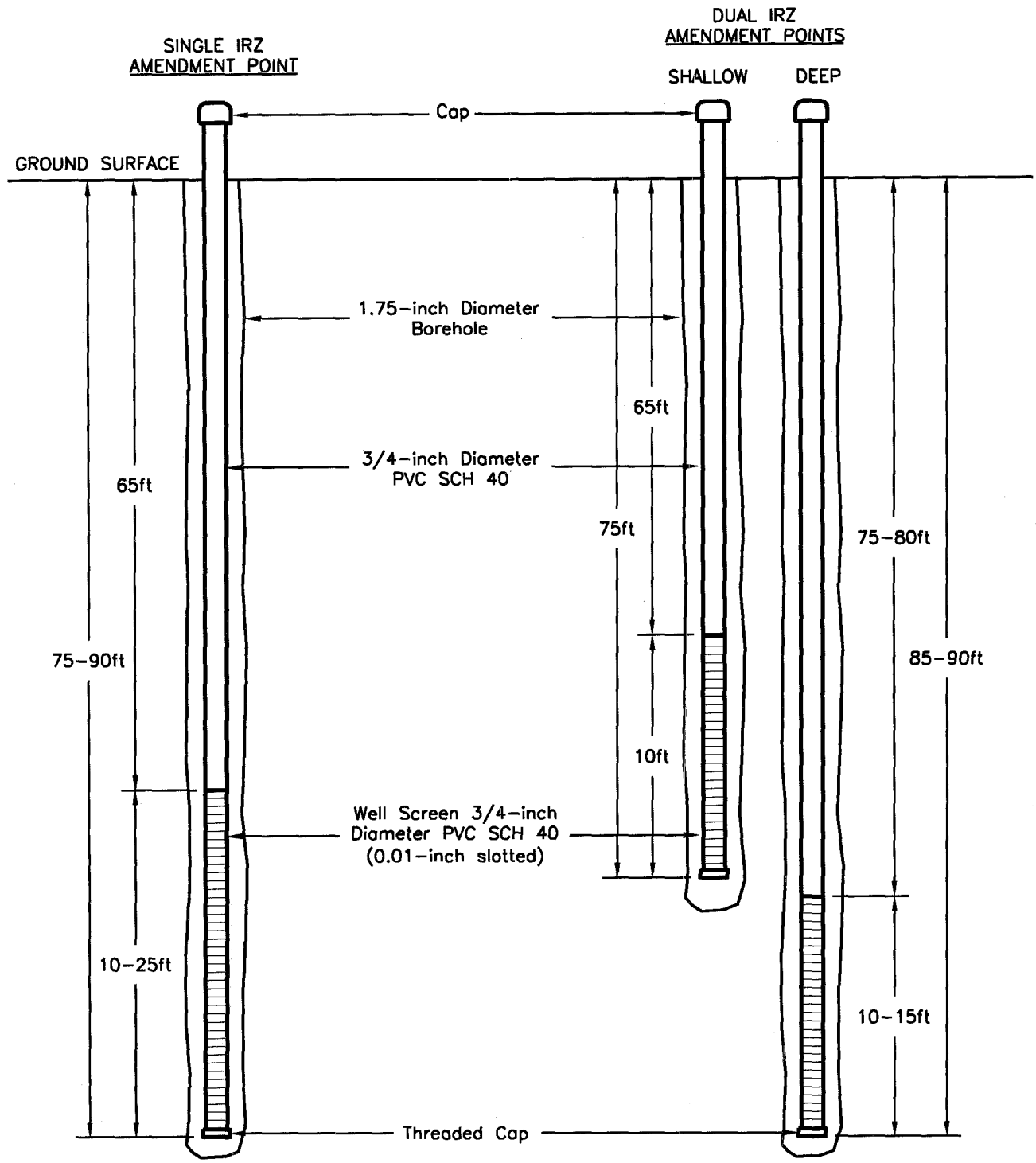
HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS
ENGLAND GEOSYSTEM

BOEING REALTY CORPORATION,
FORMER C-6 FACILITY
LOS ANGELES CALIFORNIA

FIGURE: 6

BUILDING 2
PROPOSED IRZ AMENDMENT POINTS AND MONITORING WELL LAYOUT

SCALE: 1" = 100 feet | PROJECT: 27285
DRAWN: SAL | REVIEWED: SZ | DATE: 8 MAY. 2001



LEGEND

PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
ft	FEET

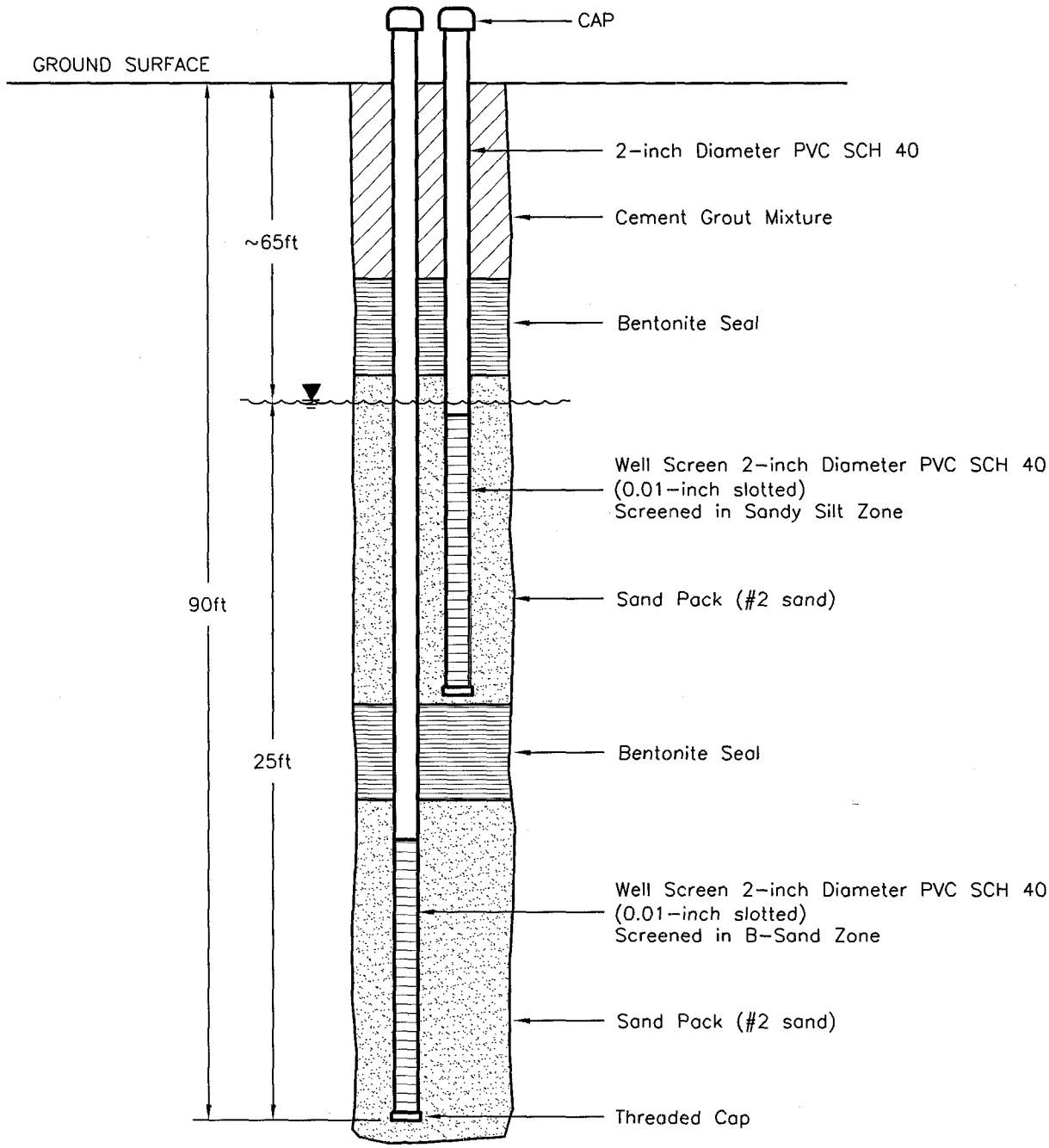
NOT TO SCALE

ARCADIS
GERAGHTY&MILLER

TYPICAL CONSTRUCTION DETAILS FOR IRZ AMENDMENT POINTS

BOEING REALTY CORPORATION,
FORMER C-6 FACILITY (BUILDING 2 AREA)
LOS ANGELES, CALIFORNIA

FIGURE
7



LEGEND

PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
ft	FEET

NOT TO SCALE

ARCADIS GERAGHTY&MILLER

TYPICAL CONSTRUCTION DETAILS FOR IRZ MONITORING WELLS

BOEING REALTY CORPORATION,
FORMER C-6 FACILITY (BUILDING 2 AREA)
LOS ANGELES, CALIFORNIA

FIGURE 8

DATE: 08/15/2001 | 10:57 | PRJ#: CA 594.01.01 | DWG: drawings\aproject\boeing\IRZ-WELL3 | FILE: 01-5407 | CHK: BURDICK | PM: LENZO | ART: STILES

APPENDIX A

Appendix A

WESTERN COMMERCE CORPORATION
SINCE 1939
• HONEY - BEE PRODUCTS - MOLASSES - SYRUPS - AGAVE NECTAR •
P.O. Box 90190, City of Industry, CA 91715-0190
636 Turnbull Canyon Road, City of Industry, CA 91745-1186

PRODUCT INFORMATION AND SPECIFICATIONS FOR BLACKSTRAP MOLASSES

TOTAL SOLIDS	79.5
MOISTURE	21.5
ASH	6. - 7.
PH	5.5
SUCROSE	34%
INVERT SUGARS	26%

DESCRIPTION

Western Commerce Corporation edible Blackstrap Molasses is the final liquid syrup obtained from the sugar extracting process. It is a very dark, robust tasting molasses with a slightly biter flavor. Blackstrap Molasses has the lowest sugar content and highest mineral content of all commercially available molasses.

APPLICATIONS

Fermentation systems, licorice, caramel snack items, caramel color substitute, tomato sauces, etc.

PACKING

5-gallon Pails, 2 x 2 one-half gallon Containers, Drums, Totes Tank Trucks.

STORAGE HANDLING

Blackstrap Molasses, due to its relatively low sugar content, can begin to ferment. In order to minimize this risk, the product is best stored between 60^0 - 70^0 Fahrenheit. Western Commerce Corporation can offer no guarantees relative to the shelf stability of Blackstrap Molasses. Fermentation of Blackstrap causes no health hazards and can be controlled/eliminated by heating to 190^0 Fahrenheit for approximately ten minutes.

Material Safety Data Sheet

Required under USDL Safety and Health Regulations for Shipyard Employment (29 CFR 1915)

U.S. Department of Labor
Occupational Safety and Health Administration

OMB No. 1218-0074
Expiration Date 05/31/88

WESTERN COMMERCE CORPORATION

Section I

Manufacturer's Name: Western Commerce Corporation
Emergency Telephone Number: (626) 333-5225
Address (Number, Street, City, State, and ZIP Code): 636 Turnbull Canyon Rd.
City of Industry
California 91745-1136
Chemical Name and Synonyms: SUCROSE
Trade Name and Synonyms: BLACKSTRAP MOLASSES
Chemical Family: Carbohydrate
Formula: CAS # 57-50-1

Section II - Hazardous Ingredients NOT APPLICABLE

Paints, Preservatives, and Solvents	%	TLV (Units)	Alloys and Metallic Coatings	%	TLV (Units)
Pigments		NA	Base Metal		NA
Catalyst		NA	Alloys		NA
Vehicle		NA	Metallic Coatings		NA
Solvents		NA	Filler Metal Plus Coating or Core Flux		NA
Additives		NA	Others		NA
Others		NA			NA

Hazardous Mixtures of Other Liquids, Solids or Gases: NOT APPLICABLE

	%	TLV (Units)

Section III - Physical Data

Boiling Point (°F): NOT APPLICABLE		Specific Gravity (H_2O=1): 1.40138 @ 20°C @ 79.5% solids	
Vapor Pressure (mm Hg.): NOT APPLICABLE		Percent Volatile by Volume (%): NOT APPLICABLE	
Vapor Density (AIR=1): NOT APPLICABLE		Evaporation Rate: NA (=1)	

Solubility in Water: 240 gms in 100 gms water @ 20 degrees C

Appearance and Odor: DARK CARAMEL AND SWEET

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	Lel	Uel
NOT APPLICABLE	NOT APPLICABLE		

Extinguishing Media: WATER, DRY CHEMICAL, CARBON DIOXIDE

Special Fire Fighting Procedures: NONE

Unusual Fire and Explosion Hazards: NONE

Section V - Health Hazard Data

Threshold Limit Value

NOT APPLICABLE

Effects of Overexposure

Blackstrap molasses is not a health hazard but is not recommended for human consumption.

Emergency First Aid Procedures

NOT APPLICABLE

Section VI - Reactivity Data NOT APPLICABLE

Stability			
	Unstable		Conditions to Avoid
	Stable X		

Incompatability (Materials to Avoid)

Hazardous Decomposition Products

Hazardous Polymerization			
	May Occur		Conditions to Avoid
	Will Not Occur	X	

Section VII - Spill or Leak Procedures

Steps to be Taken in Case Material is Released or Spilled

NO SPECIAL REQUIREMENTS

Waste Disposal Method

Through regular sewage system, if permitted by regulatory agencies, or waste removal. Flush with water.

Section VIII - Special Protection Information

Respiratory Protection (Specify Type)

NO SPECIAL REQUIREMENTS

Ventilation			
	Local Exhaust		Special
NA	Mechanical (General)		Other

Protective Gloves	Eye Protection
NA	NA

Other Protective Equipment

Section IX - Special Precautions

Precautions to be Taken in Handling and Storing

NOT APPLICABLE

Other Precautions

Blackstrap molasses is not recommended for human consumption.

WESTERN COMMERCE CORPORATION
SINCE 1939
• HONEY - BEE PRODUCTS - MOLASSES - SYRUPS - AGAVE NECTAR •
P.O. Box 90190, City of Industry, CA 91715-0190
636 Turnbull Canyon Road, City of Industry, CA 91745-1186

PRODUCT INFORMATION AND SPECIFICATIONS FOR LIGHT AND SWEET MOLASSES

PROPERTIES	LIGHT AND SWEET MOLASSES
BRIX AT 20°C.	79.5 - 80.5
SUCROSE	35.0% (+/- 3%)
REDUCING SUGARS	35.0% (+/- 3%)
TOTAL SUGARS	70.0 - 73.0% (+/- 3%)
SULFATED ASH	2.50 - 3.00%
SO_2	nil
pH 1 x 1 SOLUTION	4.8 - 5.5
MOISTURE	21.5 - 22.5 Maximum

DESCRIPTION

Western Commerce Corporation Light and Sweet Molasses is a light colored, first quality molasses with a high total sugar content which helps in adding shelf life to the product as well as a natural humectancy factor. It has a pronounced molasses flavor.

MICROBIOLOGICAL STANDARDS

Standard Plate Count:	5,000 /gram max.
Yeast:	100/gram max.
Mold:	100/gram max.
Salmonella	Negative
Coliform	10/gram max.

APPLICATIONS

Cakes, sauces, snack items, cereals, syrups, baked beans, breads, confections etc.

PACKING

5-gallon pails, 2 x 2-1/2 gallon containers, drums, totes, tank trucks.

Material Safety Data Sheet
Required under USDL Safety and Health Regulations for Shipyard Employment (29 CFR 1915)

U.S. Department of Labor
Occupational Safety and Health Administration

OMB No. 1218-0072

WESTERN COMMERCE CORPORATION

Section I

Manufacturer's Name: Western Commerce Corporation
Emergency Telephone Number: (626) 333-5225
Address (Number, Street, City, State, and ZIP Code): 636 Turnbull Canyon Road, City of Industry, California 91745-1136
Chemical Name and Synonyms: SUCROSE
Trade Name and Synonyms: LIGHT & SWEET MOLASSES
Chemical Family: Carbohydrate
Formula:

Section II - Hazardous Ingredients NOT APPLICABLE

Paints, Preservatives, and Solvents	%	TLV (Units)	Alloys and Metallic Coatings	%	TLV (Units)
Pigments		NA	Base Metal		NA
Catalyst		NA	Alloys		NA
Vehicle		NA	Metallic Coatings		NA
Solvents		NA	Filler Metal Plus Coating or Core Flux		NA
Additives		NA	Others		NA
Others		NA			NA

Hazardous Mixtures of Other Liquids, Solids or Gases: NOT APPLICABLE

	%	TLV (Units)

Section III - Physical Data

Boiling Point (°F)		Specific Gravity (H_2O=1)	
NOT APPLICABLE		1.40427 @ 20°C @ 78.5% solids	
Vapor Pressure (mm Hg.)		Percent Volatile by Volume (%)	
NOT APPLICABLE		NOT APPLICABLE	
Vapor Density (AIR=1)		Evaporation Rate	
NOT APPLICABLE		NA (=1)	

Solubility in Water: LIGHT & SWEET MOLASSES IS COMPLETELY SOLUBLE IN WATER.

Appearance and Odor: DARK CARAMEL AND SWEET

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	Lel	Uel
NOT APPLICABLE	NOT APPLICABLE		

Extinguishing Media: WATER, DRY CHEMICAL, CARBON DIOXIDE

Special Fire Fighting Procedures: NONE

Unusual Fire and Explosion Hazards: NONE

Section V - Health Hazard Data

Threshold Limit Value

NOT APPLICABLE

Effects of Overexposure

LIGHT & SWEET MOLASSES IS NOT A HEALTH HAZARD

Emergency First Aid Procedures

NOT APPLICABLE

Section VI - Reactivity Data NOT APPLICABLE

Stability	Unstable		Conditions to Avoid
	Stable	X	

Incompatability (Materials to Avoid)

Hazardous Decomposition Products

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

Section VII - Spill or Leak Procedures

Steps to be Taken in Case Materials Released or Spilled

NO SPECIAL REQUIREMENTS

Waste Disposal Method

THROUGH REGULAR SEWAGE SYSTEM. IF PERMITTED BY REGULATORY AGENCIES,

OR WASTE REMOVAL. FLUSH WITH WATER.

ection VIII - Special Protection Information

espiratory Protection (Specify Type)

NO SPECIAL REQUIREMENTS

ntilation	Local Exhaust	Special
NA	Mechanical (General)	Other

ective Gloves NOT APPLICABLE

Eye Protection NOT APPLICABLE

her Protective Equipment

NOT APPLICABLE

ction IX - Special Precautions

cautions to be Taken in Handling and Storing

NOT APPLICABLE

er Precautions

NONE